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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: William KUNG, et al.
SERIAL NO.: NEW U.S. PCT APPLICATION
FILED: HEREWITH
INTERNATIONAL APPLICATION NO.: PCT/CA04/00014
INTERNATIONAL FILING DATE: January 6, 2004
FOR: MULTI-MODE MODULATOR AND TRANSMITTER

REQUEST FOR PRIORITY UNDER 35 U.S.C. 119 AND THE INTERNATIONAL CONVENTION

Commissioner for Patents
Alexandria, Virginia 22313

Sir:

In the matter of the above-identified application for patent, notice is hereby given that the applicant claims as priority:

COUNTRY	APPLICATION NO	DAY/MONTH/YEAR
Canada	2,415,668	06 January 2003

Certified copies of the corresponding Convention application(s) were submitted to the International Bureau in PCT Application No. PCT/CA04/00014. Receipt of the certified copy(s) by the International Bureau in a timely manner under PCT Rule 17.1(a) has been acknowledged as evidenced by the attached PCT/IB/304.

Respectfully submitted,
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La présente atteste que les documents ci-joints, dont la liste figure ci-dessous, sont des copies authentiques des documents déposés au Bureau des brevets.

This is to certify that the documents attached hereto and identified below are true copies of the documents on file in the Patent Office.

Specification and Drawing, as originally filed, with Application for Patent Serial No: **2,415,668**, on January 6, 2003, by **SiRiFIC WIRELESS CORPORATION**, assignee of William Kung and Christopher Eugene Snyder, for "Integrated, Configurable Multi-Mode Transmitter".

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Agent certificateur/Certifying Officer

February 6, 2004
Date

Canada

(CIPO 68)
04-09-02

OPIC CIPO

SiRiFIC WIRELESS CORP. - INVENTION DISCLOSURE FORM

TITLE OF INVENTION: Integrated, Configurable Multi-mode Transmitter

ADDRESS:

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Please Answer the following questions and attach any documents/publications/disclosures:

1. Discuss the relevant area or areas of technology.
The invention is relevant in the area of integrated radio transmitters. The invention is a method of realizing a configurable, multi-mode transmitter.

2. What problem or problems exist that your invention may solve?

Conventional, integrated transmitter architectures suffer from a variety of limitations in the context of realizing a single transmitter that is capable of operation across multiple standards (i.e. multi-mode). The proposed transmitter architecture avoids these limitations. Prior art includes indirect modulation, direct modulation, translational loop, and some proprietary architectures.

For example, indirect modulation is a proven architecture and has the advantages of high overall performance in terms of noise, linearity and power/gain control. However, the architecture is relatively costly to implement due to the need for IF and RF filters. As well, realization of a multi-mode, multi-band transmitter is generally not possible using indirect modulation.

Direct modulation has the advantages of simplified frequency planning, low cost implementation, and compatibility with multiple modulation formats. However, it suffers from limited power and gain control (while maintaining satisfactory performance) in a single, integrated circuit.

A pseudo-direct modulation architecture has been proposed by SiRiFIC Wireless, Inc. (see PCT publication nos. WO 01/17120, WO 01/17121 and WO 01/17122). This architecture is also compatible with multiple modulation formats and can be implemented at low cost. Circuit complexity is higher than in direct modulation.

The proposed transmitter exploits the virtues of direct modulation and pseudo-direct modulation as proposed by SiRiFIC Wireless, Inc., in a non-obvious manner. The proposed architecture is illustrated in the Section 5.

The architecture simultaneously resembles both a transmitter based on direct modulation and one based on SiRiFIC's conversion IP, with the following innovations:

- **variable gain amplifiers A3, A4 are inserted between 1st mixers M1, M2 and 2nd mixers M3, M4.**
- **variable gain amplifier A5 is inserted following 2nd mixers M3, M4.**
- **control circuitry C1, which controls the transmitter mode of operation.**

At high output/high gain control settings, the transmitter is configured as a direct modulator. At low output/low gain control settings, the transmitter is configured as a pseudo-direct modulator, based on SiRiFIC's conversion IP. The net result is an integrated, configurable, multi-mode transmitter. Virtues of the novel transmitter are simplified frequency planning, low cost of implementation, compatibility with multiple modulation formats, and wide output power/gain control range.

3. How has this problem, or similar problems, been solved in the past?

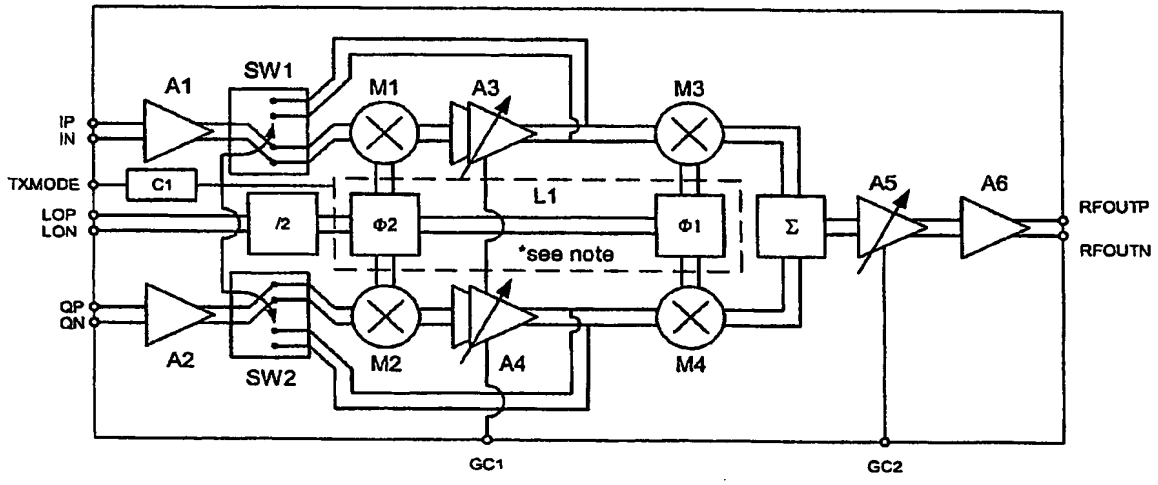
To date, multiple transmitters have been employed to support multiple modes (standards). Careful design and planning have also been employed to implement a transmitter for two or more standards, but the implementation is very specific.

4. What are the advantages of your invention?

Key advantages of the invention are as follows:

- **transmitter architecture is capable of supporting multiple modes (standards)**
- **cost of implementation is low**
- **filter requirements are reduced**
- **only one high-quality LO is required**
- **level of integration is high**

5. Explain, in detail, preferably with the assistance of drawings or flowcharts, the best embodiments or examples of your invention. Include a list of components, if appropriate.



* SiRiFIC conversion IP (prior art)

Figure 1: Proposed invention.

Amplifiers A1 and A2 are used in both direct modulation and pseudo-direct modulation modes of operation. They buffer and amplify the input signals at baseband frequencies.

Mixers M1 and M2 are used in the pseudo-direct modulation mode of operation.

They mix the baseband input signals to a pseudo-IF.

Amplifiers A3 and A4 are used in the pseudo-direct modulation mode of operation. They vary the signal gain and power at pseudo-IF via control signal GC1.

Mixers M3 and M4 are used in both direct modulation and pseudo-direct modulation modes of operation. They mix the signals to the final RF.

Amplifier A5 are used in both direct modulation and pseudo-direct modulation modes of operation. They vary the signal gain and power at RF via control signal GC2.

Amplifier A6 is used in both direct modulation and pseudo-direct modulation modes of operation. It buffers and amplifies the resultant RF signal.

Circuit block L1 is based on SiRiFIC's conversion IP and is used in pseudo-direct modulation mode. It generates the Φ1 and Φ2 signals that are applied to the mixers.

Switches SW1 and SW2 are controlled via circuit block C2 and are used to select the transmitter mode of operation between direct modulation and pseudo-direct modulation. For operation as a direct modulator, SW1 and SW2 connect A1 and A2 to M3 and M4 inputs. For pseudo-direct modulation, SW1 and SW2 connect A1 and A2 to M1 and M2 inputs.

Circuit block C1 selects the transmitter mode of operation between direct modulation and pseudo-direct modulation via control of switches SW1, SW2 and circuit block L1. In a typical application, it sets the operating mode to direct modulation at higher output power/gain control settings and sets the operating mode to pseudo-direct modulation at lower output power/gain control settings.

Circuit block /2 divides the incoming LO signal by 2 in frequency, which minimizes carrier leakage at the RF output.

6. Repeat item (5) above, for any other important embodiments or examples of your invention.
   - **The circuits above can be implement using bipolar technology, CMOS technology, BiCMOS technology, or another semiconductor technology.**
   - **Control circuit C1 and control signals GC1, GC2 may be merged into a single circuit that controls output power/gain and mode of operation.**

7. What are the primary elements of the invention?

   Primary elements of the invention are as follows:
   - **variable gain amplifiers A3, A4**

- **mixers A1, A2, A3, A4**
- **LO circuit L1**
- **control circuit C1**

8. What are the other important elements of your invention?

Other important elements of the invention are as follows:

- **variable gain amplifier A5**
- **divide-by-2 circuit /2**

9. Who is/are the inventor(s)? Please provide their name(s), address(es) and citizenship.

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Embodiments of the invention include:

1. An integrated radio transmitter comprising:

control circuitry for controlling the transmitter mode of operation.

2. The transmitter of item 1, in which said control circuitry is configured to operate said transmitter in a direct modulation mode at high output/high gain control settings, and operate said transmitter in a pseudo-direct modulation mode at low output/low gain control settings.

3. A configurable, multi-mode transmitter comprising:

a switch for selecting between a direct-modulation mode and a pseudo-direct modulation mode.

4. A configurable, multi-mode transmitter comprising:

control circuitry for controlling the transmitter mode of operation.

5. A method of implementing a radio transmitter comprising the step of: selecting between a direct-modulation mode of operation and a pseudo-direct modulation mode of operation.

6. An improved radio transmitter comprising: a variable gain amplifier inserted between a first mixer and a second mixer.

7. The transmitter of item 6, in which said first and second mixers are being used in a virtual-local oscillator mode.

8. A method of implementing a radio transmitter comprising the steps of: operating said transmitter in a direct modulation mode at high output/high gain control settings, and operating said transmitter in a pseudo-direct modulation mode at low output/low gain control settings.

9. A system for executing the method of any one of the above embodiments.

10. A computer readable memory medium for storing software code executable to perform the method of any one of the above embodiments.

11. A carrier signal incorporating software code executable to perform the method of any one of the above embodiments.

12. A data structure comprising the output data of any one of the above embodiments.

document no.: 212023